EchoMatch: Partial-to-Partial Shape Matching via Correspondence Reflection

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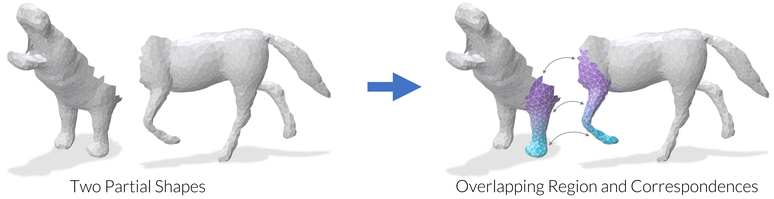
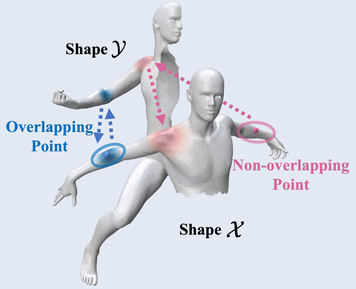
Code&Paper

Partial-to-Partial Shape Matching



Find overlapping region and correspondences between two partial shapes.

Key Contributions



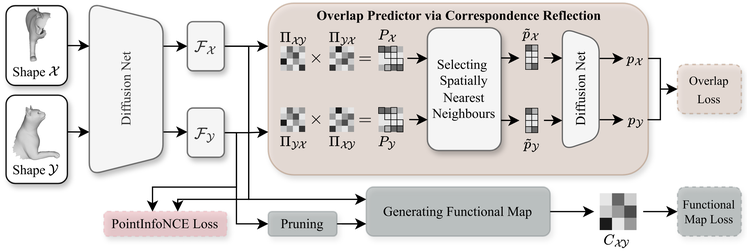
- We propose a **novel overlap predictor** for mesh-based shape matching that checks whether a point would return to its neighbourhood after forward-backward matching.
- We present a **new shape matching framework** that embeds this overlap predictor in a functional map framework.
- We **outperform previous SOTA methods** in partial-to-partial shape matching by a large margin.

Related Work

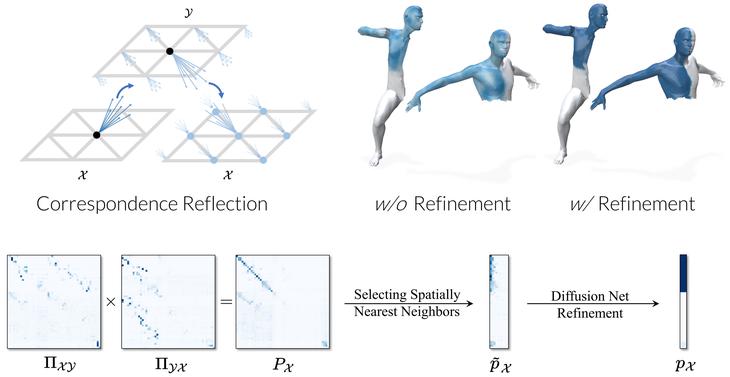
Method	Approach	High-Res	Fast Inference	Accurate Matchings	Accurate Overlap
SM-COMB[4]	Axiomatic	✗	✗	✗	✗
GC-PPSM[3]	Axiomatic	✗	✗	✗	✗
DPFM [1]	Learning	✓	✓	(✓)	✗
Ours	Learning	✓	✓	✓	✓

We tackle problems of previous methods by addressing the overlap prediction in a learning-based framework.

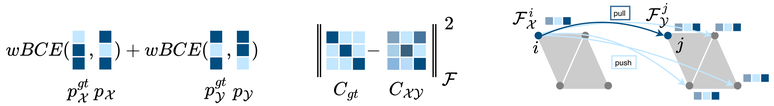
Pipeline



Overlap Predictor

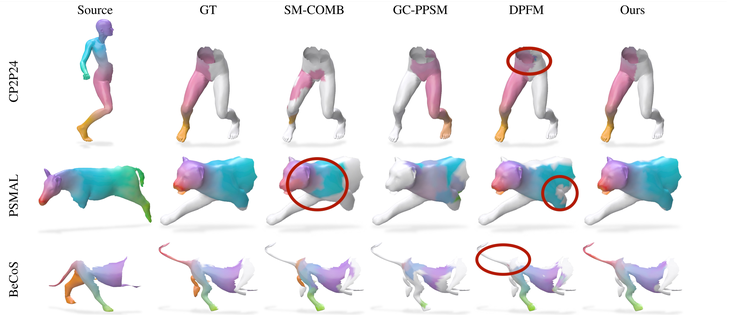


Loss Formulations

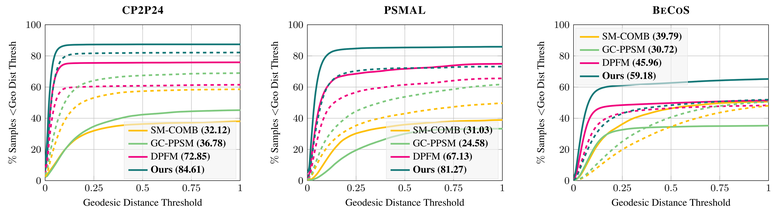


Overlap Loss Functional Map Loss PointInfoNCE Loss

Qualitative Results



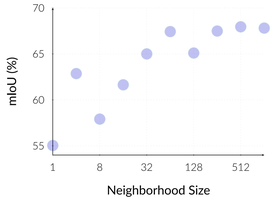
Quantitative Results



Overlap

Methods	Features	CP2P24 [1, 3]	PSMAL [3]	BeCoS [2]
SM-COMB [4]	*XYZ*	57.86*	54.76*	47.04
	DINOv2	38.38	36.61	48.29
GC-PPSM [3]	*XYZ*	69.29*	64.34*	49.34
	DINOv2	49.66	34.30	33.14
DPFM [1]	*XYZ*	63.86	67.04	48.18
	DINOv2	74.15	73.67	51.02
Ours	*XYZ*	80.10	72.71	52.40
	DINOv2	**84.72**	**84.75**	**64.68**

Neighbourhood Ablation



[1] Souhaib Attaiki, Gautam Pai, and Maks Ovsjanikov. Dpfm: Deep partial functional maps. In *3DV*, 2021.
[2] Viktoria Ehm, Nafie El Amrani, Yizheng Xie, Lennart Bastian, Maolin Gao, Weikang Wang, Lu Sang, Dongliang Cao, Zorah Lähner, Daniel Cremers, et al. Beyond complete shapes: A quantitative evaluation of 3d shape matching algorithms. *SGP*, 2025.
[3] Viktoria Ehm, Maolin Gao, Paul Roetzer, Marvin Eisenberger, Daniel Cremers, and Florian Bernard. Partial-to-partial shape matching with geometric consistency. In *CVPR*, 2024.
[4] Paul Roetzer, Paul Swoboda, Daniel Cremers, and Florian Bernard. A scalable combinatorial solver for elastic geometrically consistent 3d shape matching. In *CVPR*, 2022.

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